MESSENGER-SOC-PIPE

End-User's Guide

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(last Updated: November 12, 2007)

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1. Introduction

1.1. Who Should Read This Guide

This guide is written for members of the MESSENGER team interested in the access of products located at the SOC PIPE system. The goal of this document is to provide a starting point for new data users, and introduce the different interactive data access tools and supporting documentation associated to the MESSENGER SOC PIPE system.

As necessary the guide makes references to other documents that provide more in-depth information. The list of all documents is presented in Table 1

1.2. Main Functions Provided by this Guide

1.2.1. Access Control

1.2.1.1. POC for Access Request

The Point of Contact for requesting username/password values for the SOC main website or the password protected links is Susan Schneider: **Susan.Schneider@jhuapl.edu**. Since the SOC PIPE system is hosted at APL it requires APL's provide to grant access to external users.

1.2.1.2. POC for Issues Related to SOC-PIPE

The Point of Contact for notification of suggestion/issues/problems related to the PIPE interface (see Chapter 3) is Mr. Raymond Espiritu **respiritu@actgate.com**.

1.2.2. Access to Products at the SOC

Access to the SOC products is primarily done through HTML via a web browser client, such as Microsoft Internet Explorer or Mozilla Firefox. The SOC website is **http://bronte.jhuapl.edu/**.

The website itself is protected by a user authentication protocol. Certain individual IP addresses have been added to an automatic authentication protocol, thus these machines bypass the user authentication process. Client browsers that are not on the "trusted IP address" list must login

with the username and password given by the SOC manager. Contact the SOC manager via email **Susan.Schneider@jhuapl.edu** to request the username and password to access the SOC website.

1.2.3. Description of Access/ Submission Methods

The homepage of the SOC website contains links to the various products archived at the SOC. Most of them are self-explanatory. The SPICE link, for example, contains the repository of SPICE kernels, SPICE documentation, and links to the NAIF website and MESSENGER SPICE workshop presentations.

The most populous data products are the EDRs for each individual instrument. These EDRs can be accessed by several methods. These methods are described in Chapters 2 and 3 of this document.

1.2.4. List of SOC Products

The following is a list of the products that are currently being served by the SOC and which are accessible via the SOC website:

- EDR data products for each instrument
- Flight Data Packet archive summary tables
- The MOC to SOC file transfer status web pages
- Spacecraft State of Health packet files
- MDIS Ground calibration analysis
- Science Operations and Project Library (a separate user/password authentication is required to access this link)
- PDS Peer Review documentation (a separate user/password authentication is required to access this link)
- Other documentation related to PDS and the Data Archive Working Group
- The SCIBOX tool (a separate user/password authentication is required to access this link)
- The SPICE kernel repository and SPICE documentation
- Instrument documentation (a separate user/password authentication is required to access this link)

Future products will include:

- Calibrated Data Records (CDRs) and Reduced Data Records (RDRs) and associated documentation

An updated excel file containing the list of all products and interfaces at the SOC can be found at: **http://..... [need to activate this link]**

1.3. Data Format Description Documents

Data Format Related documents, i.e. the individual Software Interface Specifications for all the MESSENGER products can be found from the MESSENGER SOC web page. Until the data is delivered to PDS, these documents are considered live documents. The present location for these documents is: **http://bronte.jhuapl.edu/**...

1.4. Data Access Related Documentation

This guide provides the initial information related to interfacing with the PIPE system.

The table in the following page provides a summary/guide to the different documents that could be useful to the SOC user. The following are documents that are referenced in this manual and that provide detailed information on different aspects of the SOC PIPE system. . Web based versions of these documents can be accessed. These are live documents where additional functionality is added on a regular basis.

Table 2 SOC PIPE Data Access Related Documents

Document Name	Description/status	Key Target User	Status	References To:

MESSENGER-SOC-PIPE End-User's Guide	Good starting point for a new user to the MESSENGER SOC Data	• Data Users of MESSENGER data, e.g.
		  • Science Team
		  • Instrument team
			Initial version ready	WIPE/PIPE ICD
				
				REACT/MSHELL User's Manual

ACT-REACT / MSHELL **User's Manual**	This document provides a description of the REACT GUI, plus it provides detail information for the MSHELL scripting language that is used by REACT and PIPE. This document provides also discussion on the targeting capabilities.	• Users interested in finding and/or visualizing MESSENGER data • Science Team Members interested in writing algorithms for PIPE or REACT • Science Team members interested in using REACT for targeting	Working version for MSHELL part is ready	WIPE/PIPE ICD
PIPE/WIPE Interface Control Document	This document is mostly useful for **programmers** that want to access data from PIPE via the provided API's	• Developers interested in accessing PIPE via provided network centric API's	Working version is ready	
PIPE/WIPE Administrator Manual **and** **WIPE Data Base Manager**	This document is for the exclusive use of the PIPE **Administrators** . This document is critical for administrators of the WIPE/PIPE server main database.	• ACT PIPE engineers, i.e. PIPE Administrators	Working version is ready	REACT/MSHELL User's Manual

2. File System Data Access

Select users will have the ability to access the EDRs directly via the APL network file system. However, this requires the user to be logged in to the APL network and as such will not be the common nor suggested method of browsing the EDRs. Access to the other SOC products, such as documentation or SPICE kernels, should be done via a web browser and connecting to the SOC website.

If you are accessing the APL network via an SSH interface or through a Linux terminal, the path to the MESSENGER EDRs is /project/messenger/SOC/pipe/edr_products. The subfolders are named after the various MESSENGER instruments: epps, grs, mag, etc.

The recommended method of retrieving any SOC products (including EDRs) is via a web browser. This is described in the following section.

3. Browser Based Access

3.1. Introduction

Browser-based access is the most common and the recommended method of connecting to the SOC to retrieve data products. Browser-based access refers to access via a web browser such as Internet Explorer or Mozilla Firefox. Thus, even browsable directories are included in this section, as they require the use of a web browser.

Browser access consists of pointing the web browser to the SOC website: **http://bronte.jhuapl.edu/** and retrieving the data products or browsing for additional information, i.e.

Figure 1Main SOC Web page (entry point)

3.2. Instrument Data (including EDR's)

3.2.1. PIPE's Packet Browser

A PIPE process running on a SOC server creates web pages which show the number and type of telemetry packets which have been downloaded to the MESSENGER spacecraft. The process queries the MOC archive, which contains all the packets downloaded from the spacecraft since launch.

The user can access this browser by clicking on the link: **Flight Packet Archive Summary tables** on the SOC homepage. From there the user can browse for packet summaries by YEAR or by the Application ID (AppID) assigned to the packet type. Selecting a year directory displays the html files that contain a weekly packet summary. Clicking on a weekly packet summary html file reveals a web page such as the one displayed below:

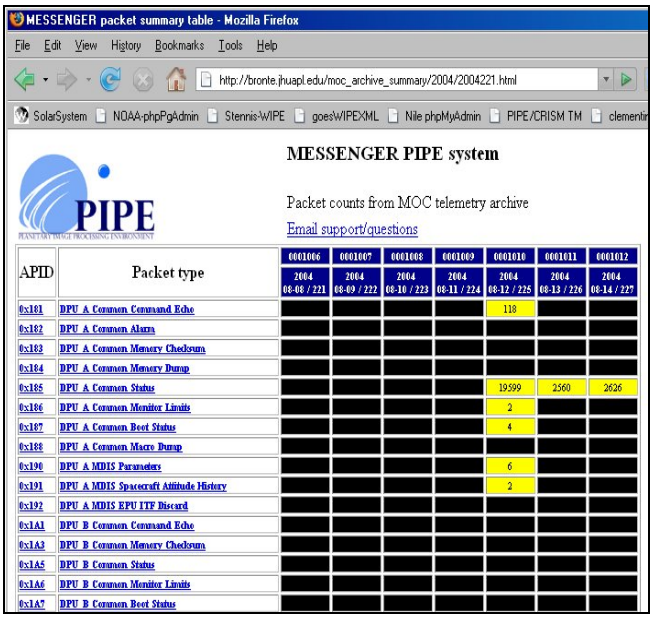

MESSENGER packet summary table - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://bronte.jhuapl.edu/moc_archive_summary/2004/2004221.html
SolarSystem NOAA-phpPgAdmin Stennis-WIPE goesWIPEXML Nile phpMyAdmin PIPE/CRISM TM
PIPE
MESSENGER PIPE system
Packet counts from MOC telemetry archive
Email support/questions
APID
Packet type
0001006 2004 08-08 / 221
0001007 2004 08-09 / 222
0001008 2004 08-10 / 223
0001009 2004 08-11 / 224
0001010 2004 08-12 / 225
0001011 2004 08-13 / 226
0001012 2004 08-14 / 227
0x181 DPU A Common Command Echo 118
0x182 DPU A Common Alarm
0x183 DPU A Common Memory Checksum
0x184 DPU A Common Memory Dump
0x185 DPU A Common Status 19599 2560 2626
0x186 DPU A Common Monitor Limits 2
0x187 DPU A Common Boot Status 4
0x188 DPU A Common Macro Dump
0x190 DPU A MDIS Parameters 6
0x191 DPU A MDIS Spacecraft Attitude History 2
0x192 DPU A MDIS EPU ITF Discard
0x1A1 DPU B Common Command Echo
0x1A3 DPU B Common Memory Checksum
0x1A5 DPU B Common Status
0x1A6 DPU B Common Monitor Limits
0x1A7 DPU B Common Boot Status

Figure 2 Weekly Packet Summary Table

The html filename (2004221.html) has the day of year corresponding to the starting day of year (221) in the weekly summary. The HTML page itself shows the weekly packet summary in table format. The first two columns show the AppID (in hex) of the packet and the description of the packet itself. The remaining seven columns show the day of year and the number of packets of that AppID which were downloaded on a given day. The table itself is sorted in AppID ascending order.

The user may also click on the links in the first two columns, either of which will load the web page showing the summary of the specific packet type:

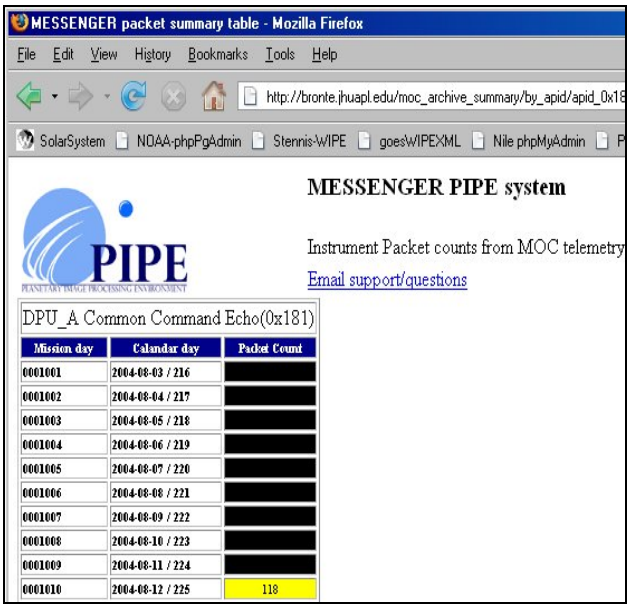


Figure 3 AppID Summary Table

The specific AppID summary table shows the packets received for that specific AppID for the entire mission. The Mission Day column shows the mission day assigned to that packet. The MOC packet archive uses the mission day for purposes of grouping packets within archive files. See the MOC-SOC ICD for more details on the Mission Day and how the value is determined by the MOC.

3.2.2. PIPE's EDR Search Engines

The EDR Search Engines are a way for the user to browse for specific EDRs that match a criteria entered via an HTML form interface. This form interface is created via a PHP web page that interacts with the PIPE Server at the SOC. The search engine can be accessed via links from the SOC main page. Currently only MDIS, VIRS, and UVVS instruments have available search engines. The other instrument search engines will be made available as they become implemented.

Examples of criteria include:

- Time ranges in MET, Absolute Date/Time or Relative Date/Time
- Instrument parameters (a specific detector or filter)
- Min/Max filters, such as a minimum or maximum integration time.

The following shows an example of an EDR Search Engine. This one is for the MASCS VIRS instrument.

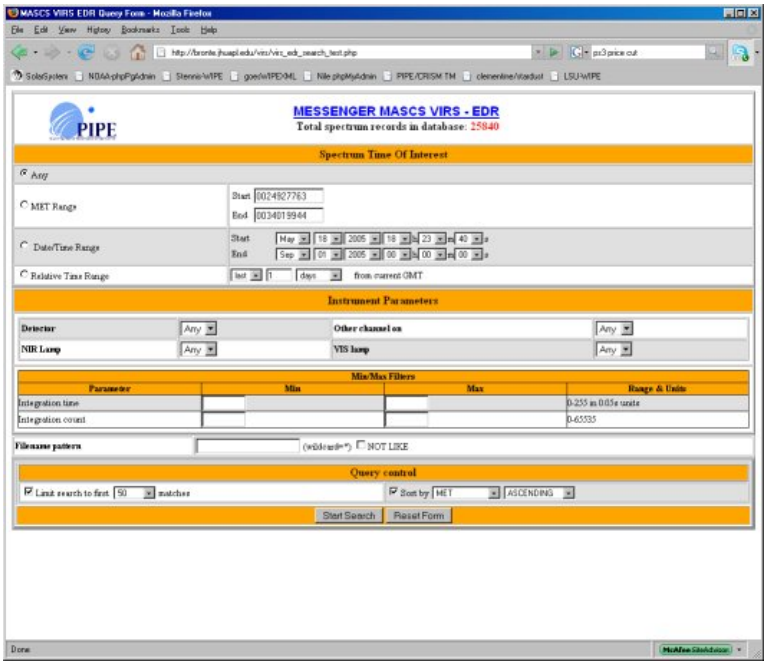
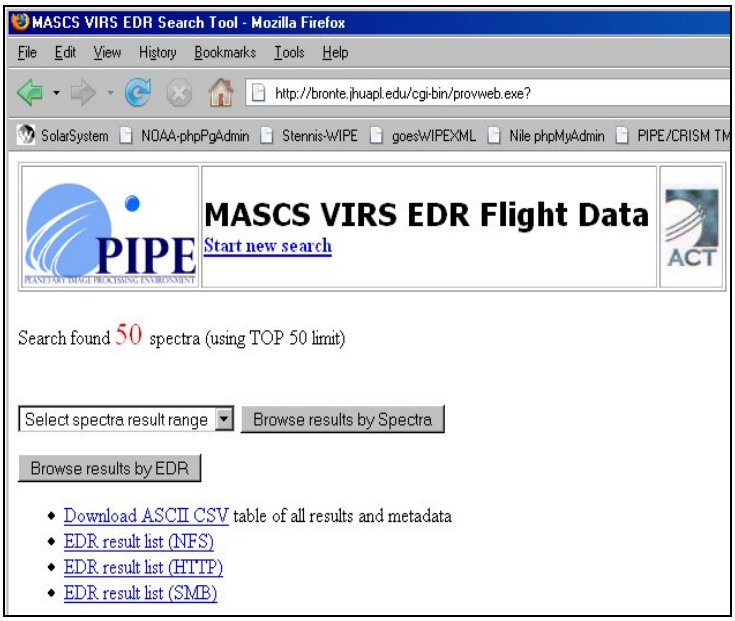


Figure 4 MASCS VIRS Search Engine

The user enters the desired criteria then clicks the "Start Search" button to implement the search for EDRs which meet the criteria. Another web page then shows the results of the search:


MASCS VIRS EDR Search Tool - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://bronte.jhuapl.edu/cgi-bin/provweb.exe?
SolarSystem NOAA-phpPgAdmin Stennis-WIPE goesWIPEXML Nile phpMyAdmin PIPE/CRISM TM
PIPE
PLANETARY IMAGE PROCESSING ENVIRONMENT
MASCS VIRS EDR Flight Data
Start new search
ACT
Search found 50 spectra (using TOP 50 limit)
Select spectra result range
Browse results by Spectra
Browse results by EDR
Download ASCII CSV table of all results and metadata
EDR result list (NFS)
EDR result list (HTTP)
EDR result list (SMB)

Typically for each instrument the user will be able to view results by spectra or by EDR. In addition, the user will be able to download a list of the EDR results or a zip file containing the EDRs which met the desired criteria.

The specific web pages which allow the user to browse the EDR content will vary dramatically between instruments and will also vary between the different types of EDRs. However, the data analysis that the search engine provides can and will be developed via consultation

with the instrument team. This is an ongoing process. If additional functionality is desired then you should contact the instrument lead with your ideas and "wish lists" and the instrument lead will contact the SOC-PIPE administrator.

3.2.3. Web Browsable Directory Access

The simplest method of accessing the EDRs will be via a browsable web directory. All EDRs will have this basic access via the SOC homepage. Clicking on the "EDR File Access" link for a given instrument will display the browsable directory tree containing the EDRs. The directory tree follows the same structure as described for the <DATA> directory by the instrument EDR SIS document.

Users may download the EDR by right clicking on the EDR link and choosing "Save Link As". The data will then be downloaded to the client machine in the path designated by the user.

Bulk EDR downloads can performed via a client application known as "wget". There is a link on the SOC homepage that describes how to use "wget" in order to perform bulk downloads. The direct link that URL is **http://bronte.jhuapl.edu/wget_doc.htm**.

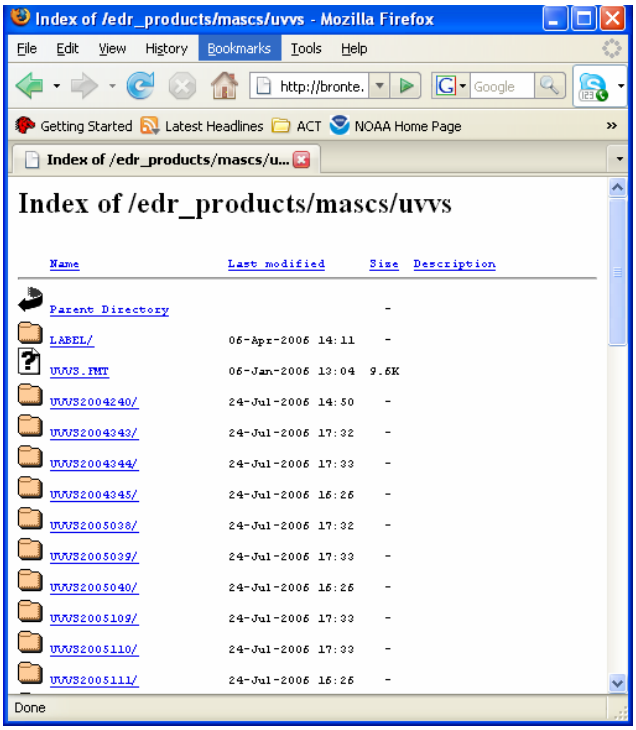

Index of /edr_products/mascs/uvvs - Mozilla Firefox
File Edit View History Bookmarks Tools Help
Getting Started Latest Headlines ACT NOAA Home Page
Index of /edr_products/mascs/u...
Index of /edr_products/mascs/uvvs
Name Last modified Size Description
Parent Directory -
LABEL/ 06-Apr-2006 14:11 -
UVVS.FMT 06-Jan-2006 13:04 9.6K
UVVS2004240/ 24-Jul-2006 14:50 -
UVVS2004343/ 24-Jul-2006 17:32 -
UVVS2004344/ 24-Jul-2006 17:33 -
UVVS2004345/ 24-Jul-2006 16:26 -
UVVS2005038/ 24-Jul-2006 17:32 -
UVVS2005039/ 24-Jul-2006 17:33 -
UVVS2005040/ 24-Jul-2006 16:26 -
UVVS2005109/ 24-Jul-2006 17:33 -
UVVS2005110/ 24-Jul-2006 17:33 -
UVVS2005111/ 24-Jul-2006 16:26 -
Done

Figure 5 Sample Web Browsable Directory Access Screen

3.2.4. CDR Search En gines

Calibrated Data Records (CDRs) have yet to be produced. As such, no CDR Search Engines exist at the SOC. These Search Engines will be created as CDRs become available at the SOC.

3.2.5. RDR Search Engines

Reduced Data Records (RDRs) have yet to be produced. As such, no RDR Search Engines exist at the SOC. These Search Engines will be created as RDRs become available at the SOC.

3.3. Attitude Related Data

3.3.1. SPICE Kernels

There is a link on the SOC which directs the user to the MESSENGER SPICE kernel repository and the SPICE documentation. It is up to the user to utilize the SPICE kernels and SPICE library to determine attitude, ephemeris, or time related information.

3.3.2. Foot-Print Directories

THESE DIRECTORIES WILL BE POPULATED LATER IN THE MISSION. They contain computed footprints as a function of time, and block data collection types.

4. REACT- Local/Remote Access

4.1. Introduction

NOTE: REACT IS NOT ACCESSIBLE YET FOR DOWNLOAD FROM THE SOC PIPE SERVER.

4.2. Access to EDRs,

REACT presently provides readers to the MDIS EDR related products. It will be enhanced during the next phase of the effort to facilitate readers into the other EDR products.

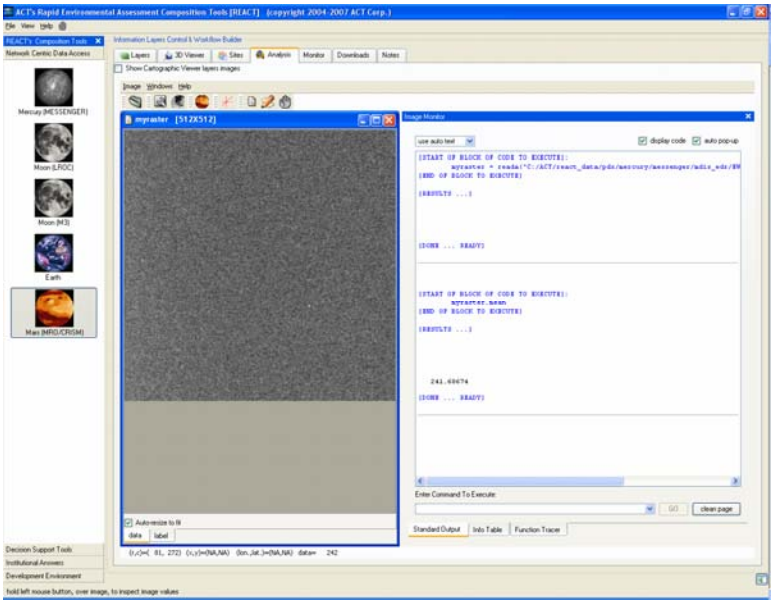
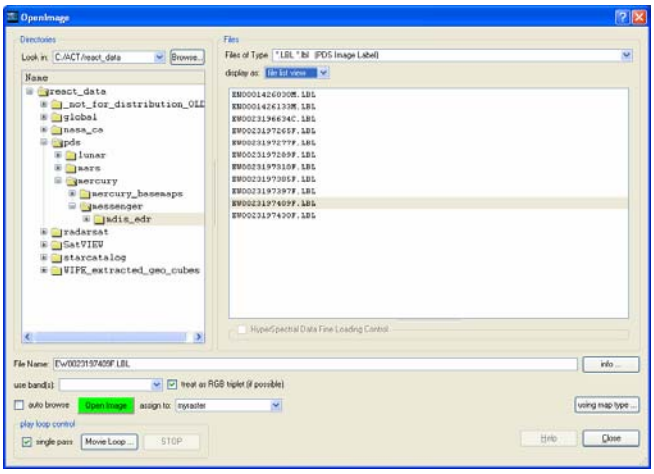
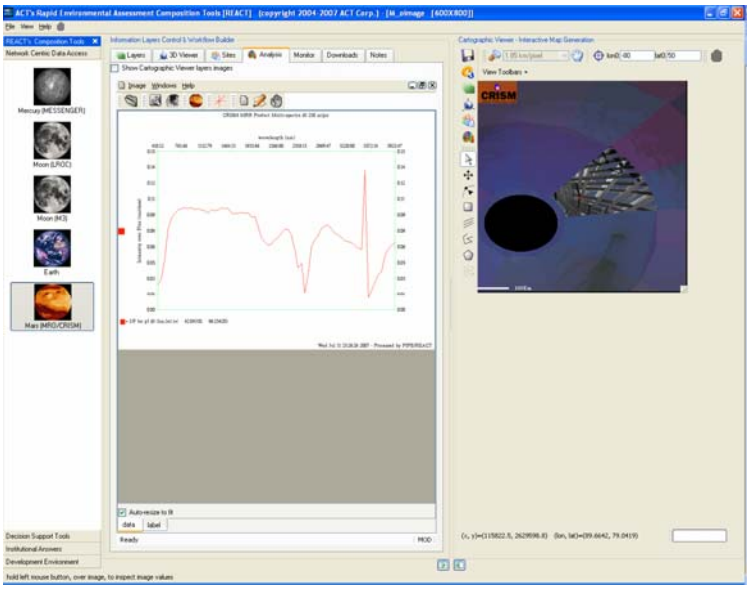


Image Selection is done from an intuitive GUI, which recognizes MESSENGER PDS formatted data, see Figure below



4.3. Access to RDR's , …

REACT can be configured to provide access to global mosaics being generated at the SOC PIPE server. An example of this is illustrated below, where a REACT client is accessing global products from the SOC CRISM server, and provides interactive access to the multi-spectral data at the user selected points.



4.4. Access to Coverage Maps

As SPICE data is processed and backplanes of information are generated, these data is distributed to REACT, allowing REACT to generate coverage maps of where the data has been collected, including how many times the same point has been observed. See Figure below,

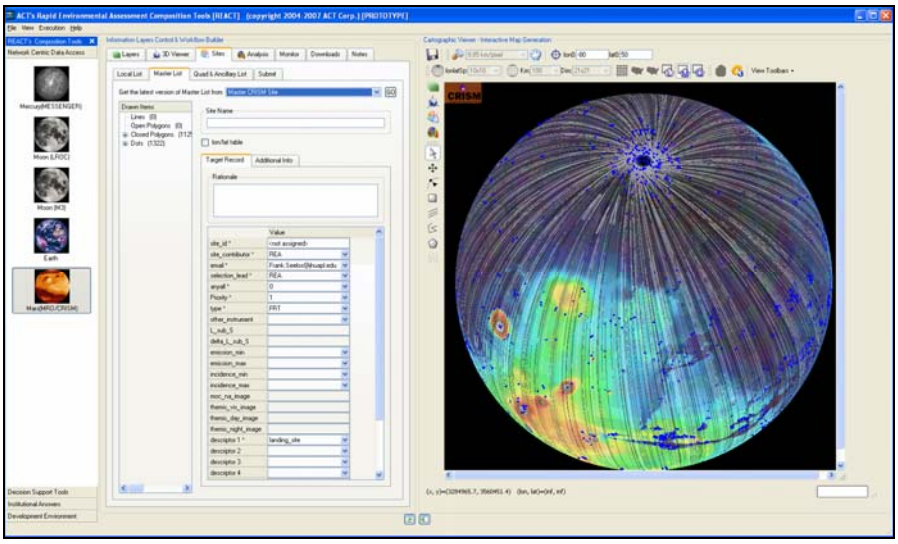


Figure 6 Sample Screen Shot of a REACT panel showing multiple sources of relevant layers simultaneously based under an interactive session.

4.5. Access to Master Target List

REACT provides the ability for Science Team members to select targets based on the historical base-map layers and to submit these targets into a master target list hosted by PIPE. The master target list is accessible from all REACT users. So that new targets can be selected under full knowledge of previously selected targets.

A tutorial on how to use REACT for target selection is in the **REACT Targeting Tutorial** document**.**

5. Automatic Data Retriever

5.1. Introduction

The MESSENGER SOC PIPE architecture has an application called the 'Update Manager'. This application is used to stay synchronized with key components of REACT and associated MESSENGER products which are determined to be needed at the Sc.Team desktop or notebook for systematic use of REACT.

For MESSENGER this upate manager will keep maintain all the required components of REACT needed to support

- Local access for latest version of SPICE kernels
- ability to read ALL EDRs
- ability to read CDRs
- targeting tools (consistent spatial reference system for all team members)
- coverage maps and supporting data
- distribution system for latest SC.Team calibration code (that is supposed to be shared)
- Regional Map product generation capability
- Test Bed for Sc.Team to construct algorithms that can be executed on the SOC/PIPE natively
- ability to run and distribute SC.TEAM provided calibration algorithms
- remote access to basemap layers (MDIS) as they are being populated
- ability to play from SOC PIPE server list of images (using Network centric access)
- ability to generate waterfall spectrum plots
- ability to prove multi-sensor or multi-spectral data (once it is geo-located)
- ability to inspect data values (plot format and table format)
- ability to load data formats that are not PDS
- ability to perform multivariable plots (interactive, based on downloads from PIPE)

The ACT's Product Manager is meant to provide the users with a common, small and easy-to-use application for installing or updating ACT products. For MESSENTER, ACT is using this tool to facilitate the Science Team to stay synchronized with key application and data components under control fo the Product-Manager.

5.2. How to Use the Product Manager

5.2.1. Installing and Starting the Product Manager

The interface (Figure 7) resembles the style of a "wizard" tool that gives the users a clear flow throughout all the steps needed to complete the process.

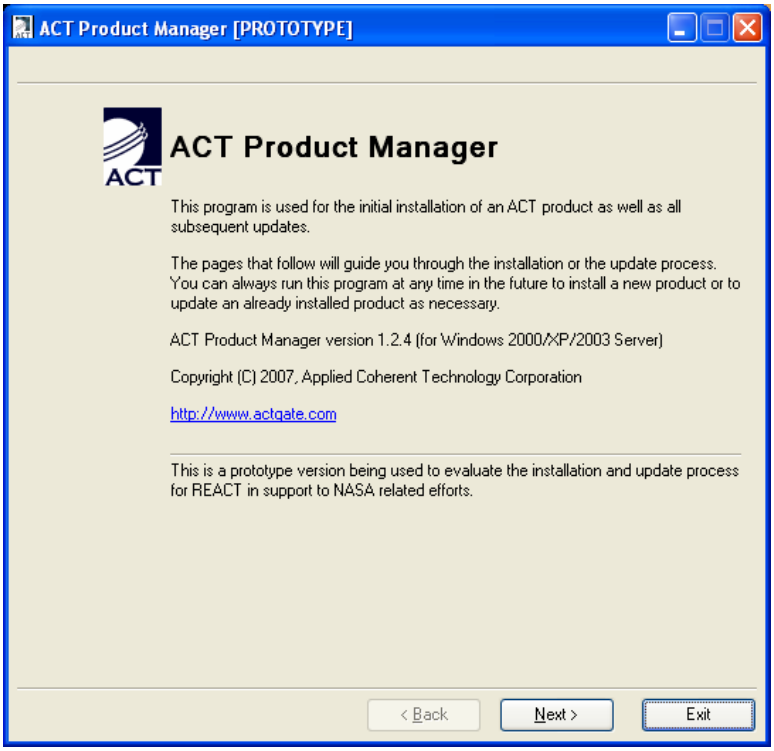

ACT Product Manager [PROTOTYPE]
ACT Product Manager
This program is used for the initial installation of an ACT product as well as all subsequent updates.
The pages that follow will guide you through the installation or the update process. You can always run this program at any time in the future to install a new product or to update an already installed product as necessary.
ACT Product Manager version 1.2.4 (for Windows 2000/XP/2003 Server)
Copyright (C) 2007, Applied Coherent Technology Corporation
http://www.actgate.com
This is a prototype version being used to evaluate the installation and update process for REACT in support to NASA related efforts.
< Back
Next >
Exit

Figure 7 A look to ACT's Product Manager

The latest version of ACT's Product Manager can be downloaded from **http://www.actgate.com/feyo/ACT-Product-Manager** and it is available for the following platforms (32 bits only):

- Microsoft Windows 2000, XP, 2003 Server
- Mostly all modern Linux distributions
- Mac OS X (Intel Platform only)

A user must have a valid account (username and password) to install an ACT product as well as for its subsequent updates.

5.2.2. ACT's Product Manager Main Jobs

The following page (Figure 8) of the ACT's Product Manager shows up three main categories of job.

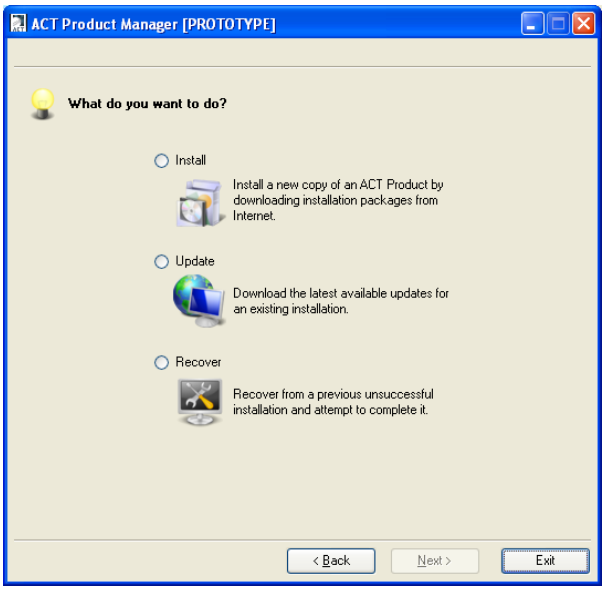

ACT Product Manager [PROTOTYPE]
What do you want to do?
Install
Install a new copy of an ACT Product by downloading installation packages from Internet.
Update
Download the latest available updates for an existing installation.
Recover
Recover from a previous unsuccessful installation and attempt to complete it.
< Back
Next >
Exit

Figure 8 ACT's Product Manager main jobs

- Install (Figure 9): a new copy of an ACT Product will be installed. The user provided directory must be blank or should not contain a previous installation (in this case ACT's Product Manager will prompt a warning message). For the time being only REACT ca be installed as an ACT Product.

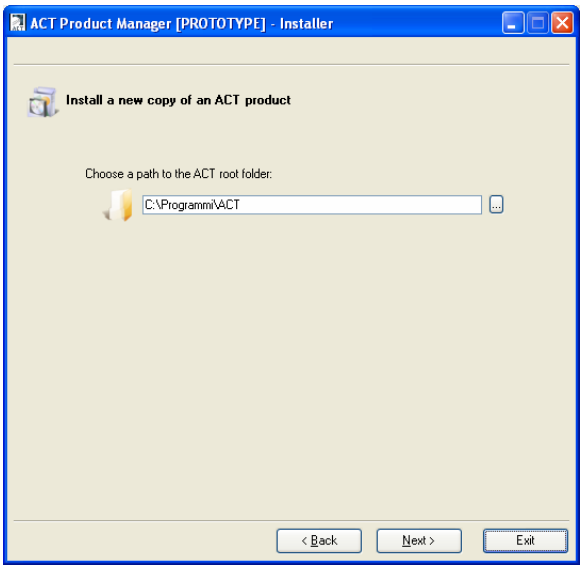

ACT Product Manager [PROTOTYPE] - Installer
Install a new copy of an ACT product
Choose a path to the ACT root folder:
C:\Programmi\ACT
...
< Back
Next >
Exit

Figure 9 Install panel

- Update (Figure 10): an existing installation of an ACT Product will be updated. In the subsequent page, the user must select

one of the existing installation from the provided list or specify the complete path to an existing installation that ACT's Product Manager is not yet aware of.

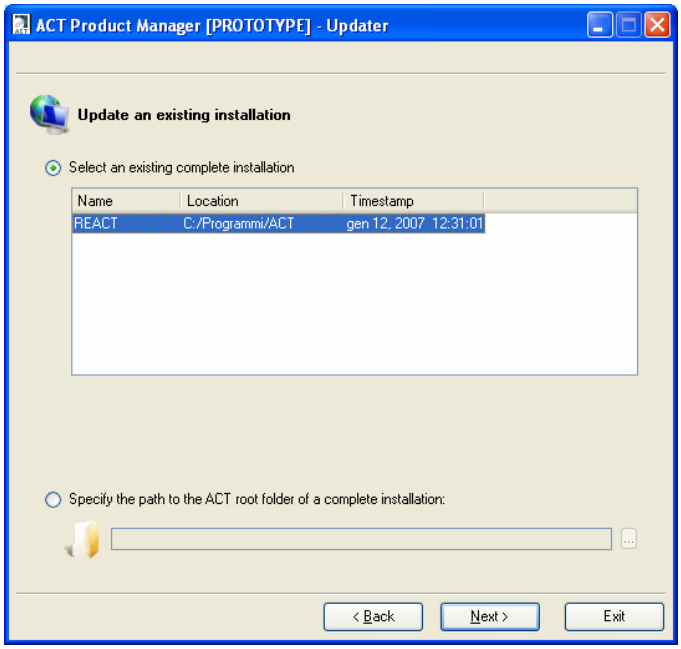


Figure 10 Update panel

- Recover (Figure 11): a previous unsuccessful installation of an ACT Product will be recovered. ACT's Product Manager will attempt to re-install the selected copy and complete the process.

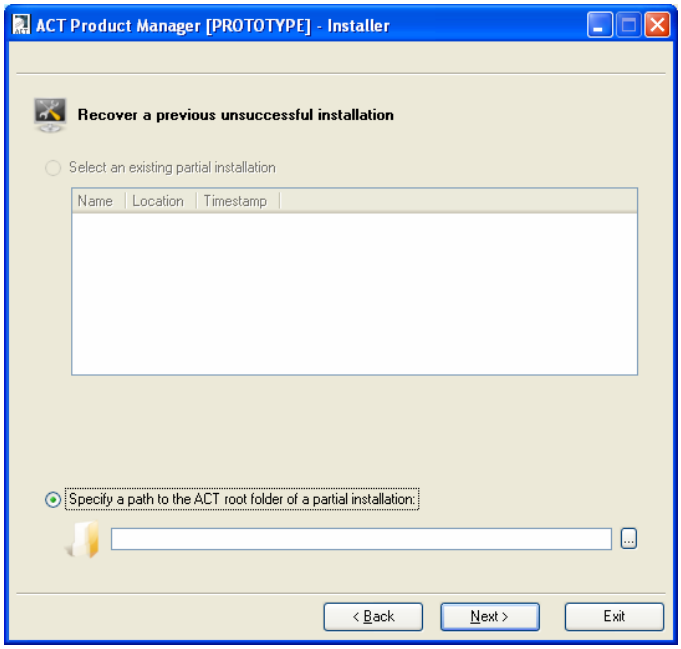

ACT Product Manager [PROTOTYPE] - Installer
Recover a previous unsuccessful installation
Select an existing partial installation
Name
Location
Timestamp
Specify a path to the ACT root folder of a partial installation:
< Back
Next >
Exit

Figure 11 Recover Panel

5.2.3. Items under Synchronization/Update Control

Once the proper job has been selected and a blank folder (for installation) or an existing installation (for update and recover) has been specified, ACT's Product Manager will start retrieving the available packages from the server. Depending on your credentials, different packages will be exposed.

The main packages for REACT product are the following:

- Binaries files (REACT executables and required libraries)
- Basic Images (sample images and base maps)
- Internal MSHELL Scripts (additional function scripts for MSHELL engine)
- MSHELL console (command line tool version of MSHELL)
- Configuration files (Multi-Layers-Tree Default Files, Target Selection Forms, Map Viewing Parameter Files)
- Base maps (images, shape files, overlays)
- User Local Environment (user scripts and local configuration files)
- Other utilities and help files (GDAL tools, ImageMagick for Windows and manuals for REACT, WIPE and MSHELL)

Each of the above categories can be installed or updated individually.

For MESSENGER, ACT can add additional products to be under the control of the Update-Manager software. The list of products distributed under the update manager many change depending on evolving needs of the MESSENGER mission.

6. Uploading Data to the SOC

6.1. Introduction

6.2. Sc.Team Data Submission Procedure

The formal procedure to submit data into a PIPE server is by placing the data file(s) into a pre-determined "incoming" directory corresponding to the data collection type. This can be accomplished by the data being **copied** into the PIPE server, **or** allowing the PIPE server to have **file-level remote access** to the input data system.

Note: If a data set is resubmitted into a WIPE server, the previously registered dataset will be overwritten.

6.3. Sc. Team Data Submission Format(s)

PIPE/WIPE can handle over 200 different data stream formats, the most recent list can be found at:

http://www.actgate.com/home/products/wipe.htm.

In general, adding a new data stream requires:

a. Association of an existing PIPE ingestion engine, or

b. Implementation of a new ingestion engine, or

c. Modification of an existing ingestion engine.

The code for all the existing ingestion and extraction engines can be found in the scripts directory of a PIPE server.

For MESSENGER higher level data products, the actual formats have not been defined yet. For each product PIPE needs an associated ingestion directory, ingestion engine, extraction engine, and possibly a search engine. Once the data formats have been defined, this section will be updated.

7. Tools for Developers

7.1. Algorithm Development

The MESSENGER SOC provides methods for Science Team Members to implement algorithms in the native scripting environment used by the SOC-PIPE system, i.e. MSHELL. MSHELL is also the same scripting language used by REACT.

If you are interested in leveraging on this SOC provided asset the REACT/MSHELL User's Manual is the key document to use.

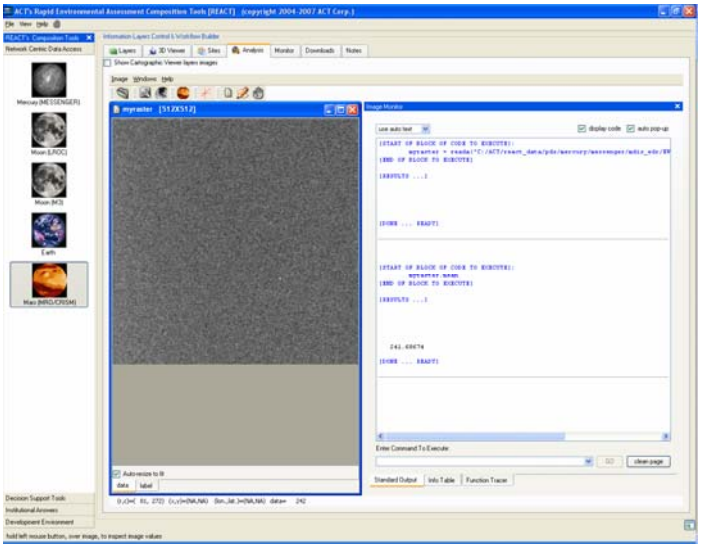
For example loading an MDIS image and computing its mean value is as simple as:

```
myraster =  reada("EW0023197409F.LBL","pds");

view myraster ;

myraster.mean
```

For learning in an interactive manner, the REACT GUI interface provides a good way of learning how to construct scripting commands, since most selections done in the GUI is translated and shown as the equivalent REACT/MSHELL commands.



7.2. Application Programmers Interface (API)

REACT provides a GUI interface for loading and interacting with many of the MESSEGNER products located in the PIPE server. Once loaded in RECT the data can be visualized. This is the simplest way of loading data into your machine as provided by the MESSENGER SOC.

If you are a programmer and are interested in having scripting control in the loading of the data, you can use the REACT/MSHELL scripting language. REACT/MSHELL permits the reading of data from the local file system or across the internet from a PIPE server. For this approach we suggest to use the REACT/MSHELL User's Manual as a reference.

If you want to access the PIPE server directly using a network centric API, the methods presently supported by PIPE are described in the PIPE/WIPE Interface Control Document. Among the functions supported are:

- Get list of data collections
- Perform and Inventory Query
- Perform a data retrieval
- …

8. Appendix: PIPE/REACT Overview

8.1. BASELINE ARCHITECTURE

The ingestion and analysis PIPE-lines are implemented using a customized version of ACT's PIPE architecture. Among the key features of this architecture are:

- Automatic assimilation/processing of geo-spatial data.
- Rapid/interactive discovery, fusion, and distribution of data.
- Configurable from a single machine to a cluster of machines.
- Easy incorporation of new data formats for ingestion and delivery.
- Flexible WEB based GIS and image processing functionality.
- Efficient use of available bandwidth.
- Extensible via user-provided algorithms and applications.
- Simple client requirement standard web browser!

Seamless interaction with advanced client applications, e.g. REACT

The PIPE/WIPE architecture uses as processing engine the MSHELL Image/Signal processing interpreter language. The language syntax has been extended to facilitate the handling of many data sets types. As shown in the above diagram, MSHELL is central to the PIPE architecture. Within PIPE there is a PIPE Data Base Manager that it is used to track all database products. The data base manager is exposed over a web interface to the PIPE administrator. In addition to the data base manager other databases critical to MESSENGER are exposed, e.g. target list manager, and the base map layer manager.

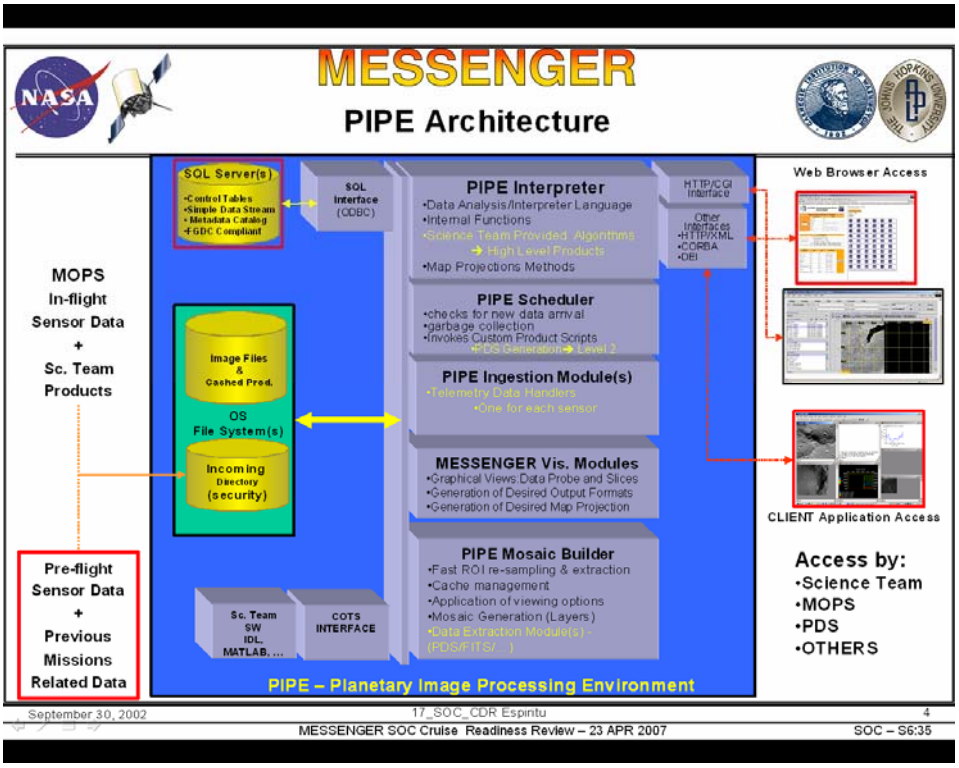


Figure 12 PIPE/WIPE High Level Architecture (from the recent SOC-RR)

A simplified data access diagram that shows the relationship of PIPE&REACT and the MESSENGER/SOC and the **MESSENGER/PIPE/Test-bed** is shown below. REACT has interactive mapping and graphics capabilities that are not accessible from PIPE directly. The MESSENGER PIPE test-bed is the site where new PIPE-line procedures are tested before becoming part of the main production. The test-bed has sufficient RAID storage to access to all the MESSENGER EDR related input/output products. The diagram also shows on the lower right some of the access tools that have been or are under implementation for MESSENGER by ACT. Part of the simplicity of this architecture is that PIPE and REACT share the same processing engine, i.e. the MSHELL image/signal processing interpreter. REACT, as a client application, does not have the high-end server functionality encountered in the PIPE server, e.g. data base manager, relational data base, and watch-dog engine.

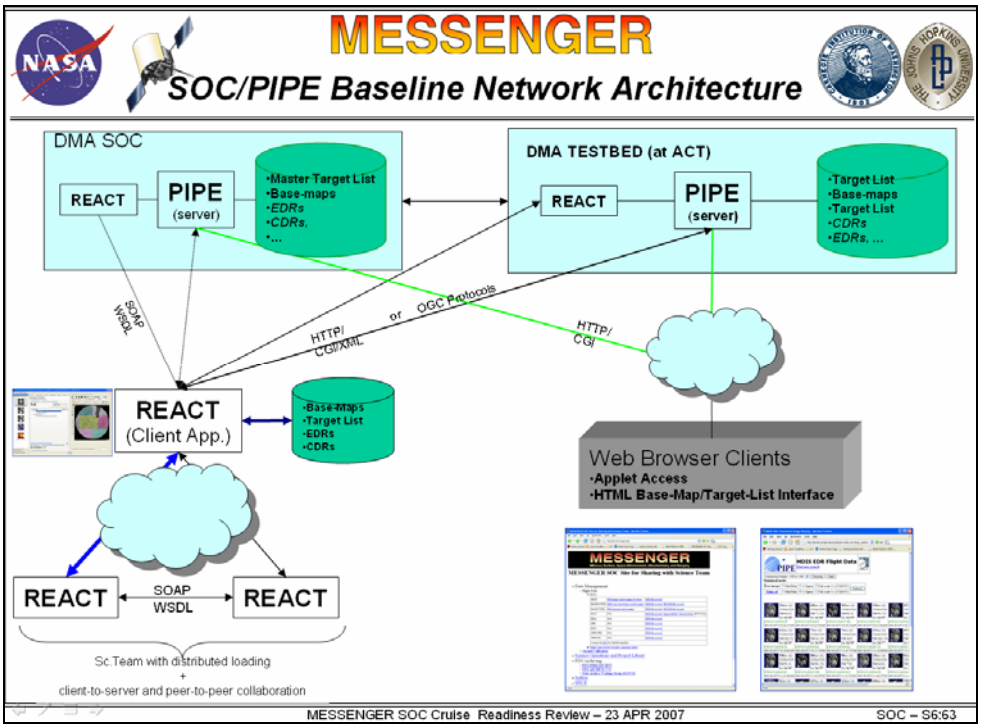


Figure 13 Baseline Architecture for SOC PIPE/REACT (from SOC-RR presentation).

REACT is a client application that works in all the key operating systems and graphical user interfaces. The end-user is exposed to four key functional tools, i.e.

- A Development Environment,
- Network Centric Data Access ,
- Decision Support , and
- Institutional Answers.

REACT is ACT's response to the vision of the Earth Science Information Partners (**ESIP**) federation, by providing an architecture that facilitates technology infusion. Combined with WIPE&PIPE it provides network centric services for reading/reprojecting/sub-setting geo-spatial satellite imagery, and the ability to create Boolean logic with data that is located on the client side or in the server side.

For MESSENGER/REACT there a number of enhanced end-user interfaces that will be exposed via REACT. Among these are:

MRO MESSENGER EDR/RDR	• Loader and Visualizer – allowing to load EDRs via GUI • Analysis Tools – allows to: look at row profiles, column profiles, spectra profiles, …, all
MESSENGER Tools	• Target Selection Tools (local list, master list [local], master list [server], MESSENGER specific tiles • EDR Calibration Modules and Configuration Panels

	for calibration – (if provided by Sc.Team)
Network Centric Cartographic Viewer Panel	• Access to local and remote basemap layers of MARS + Map projected MESSENGER products, for MDIS & MASCS , …
3D Viewer	• Allows to render in a 3d viewer selected data layers retrieved from PIPE

As an example of the above, the following screen shot depicts the target selection tool accessible via REACT. This is a new capability that was not available yet to the MESSENGER project. This tool allows a user to: select targets, record relevant information, edit content, visualize targets with respect to base-map layers, upload selected targets to a master data base, download master list, work off-line & on-line, access local layers and remote basemap layers.

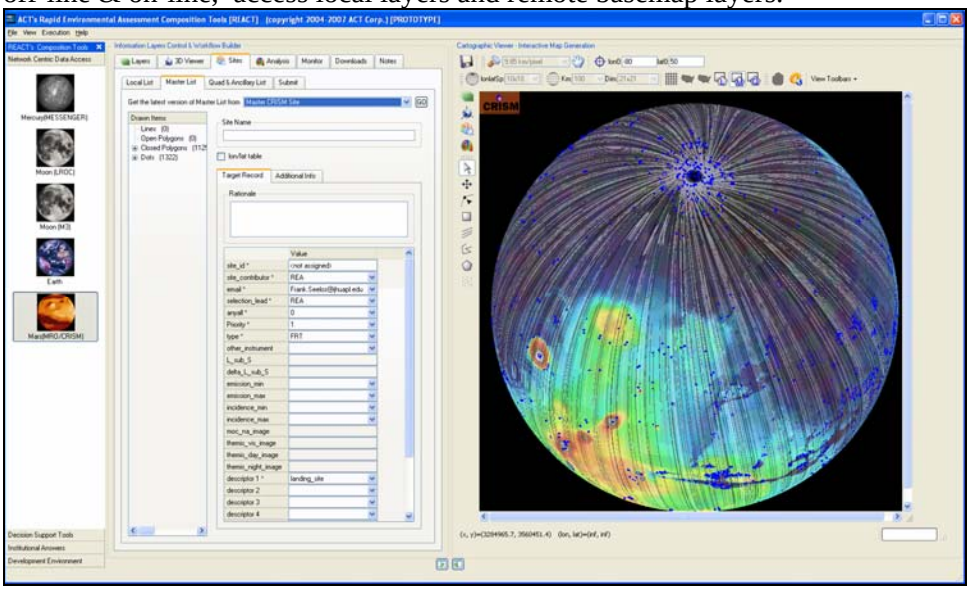


Figure 14 Sample Screen Shot of a REACT panel showing multiple sources of relevant layers simultaneously based under an interactive session.

For MESSENGER REACT will address common project needs, such as:

- distribution system for latest version of SPICE kernels
- ability to read ALL EDRs
- ability to read all CDRs
- targeting tools (consistent spatial reference system for all team members)
- " distribution system for Observation, i.e. footprints"
- distribution system for latest SC.Team calibration code (that is supposed to be shared)
- Regional Map product generation capability
- Test Bed for Sc.Team to construct algorithms that can be executed on the SOC/PIPE natively
- ability to run SC.TEAM provided calibration algorithms
- remote access to basemap layers (MDIS) as they are being populated

- ability to play from SOC PIPE server list of images (using Network centric access)
- ability to generate waterfall spectrum plots
- ability to prove multi-sensor or multi-spectral data (once it is geo-located)
- ability to inspect data values (plot format and table format)
- ability to load data formats that are not PDS
- ability to perform multivariable plots (interactive, based on downloads from PIPE)

A number data tracking and web based interfaces will continue to evolve to facilitate the access by the Science Team to MESSENGER/PIPE and the related data products. The core requirements are instrument team dependent. The details are in the SOW, on the instrument section. The following shows an existing list of interfaces or processing tools that are relying in PIPE,

- MESSENGER Base-Map Server
- MESSENGER Target List Manager
- MESSENGER Data Base Administrator
- Status Packet Search Tool
- EDR Search Engines
- CDR Search Engines (once the CDRs are available)